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separated in regard to animal distribution. This latter point goes far toward being the sole cause of regions. Any large mass of land separated from the rest of the world will, in the course of time, become inhabited by a peculiar set of animals, and obtain a comparative balance or stability of life. Thus a number of species are evolved which forms a sort of compound whole, — the life of a region. So a region may be defined as the area occupied by a peculiar grouping of animals which are isolated from the life of the rest of the world; the word 'peculiar' referring to the animals as a whole, and the isolation as of a limited and not absolute degree.

Accepting the above definition, the world can be conceived of as divided into regions, which, if the land and sea remained at rest, would be permanent, but constantly growing more and more distinct. But the land is not permanent. While the main mass is a fixture, minor changes occur, which join and separate the continents. As soon as two lands are joined, unless some other very powerful barrier exists, the life of the two at once begins to blend. The more potent kinds survive, while the weaker die out. The first, together with the life modified by the new conditions (new species evolved), in the course of time form a single region. On the other hand, if a land become divided into two, the reverse takes place, and two regions are formed. To me the palearctic and nearctic regions seem to offer illustrations of both these processes; the connection for life having been made and broken between the old and new worlds, probably by means of Asia, more than once. At present it is broken; and the nearctic and palearctic regions are formed or forming from a previous circumpolar region. With the tentative definition given here, the two are regions, since they do not form a group, and are separated. No lack of percentage differences can make the life of the two regions closely related: a change in one does not necessitate a change in the other. This also answers the circumpolar question: the resemblance in zones is due, first, to the imperfect obliteration of the old circumpolar region; and, secondly, to the fact that some of the forms which inhabited it have been driven down into the southward-pointing peninsulas, where the conditions of their life are easier. According to this definition, Madagascar should be regarded as the remains of a fading region, rather than a part of the Ethiopian. The resemblance between Africa and India is due to a southward migration which occurred not so long ago, very likely on account of the ice age, from a northern central point.

The above crude suggestions would seem sufficient to show that regions are more than numerical relations, and have an evolution of their own.

J. AMORY JEFFRIES.

Panther Creek coal-basin.

I have just read your review of the Panther Creek atlas, in *SCIENCE*, No. 11, and my attention has been directed to what I consider a very just and proper criticism of two special features of the atlas sheets: 1°. The discordant scales of the mine ($800' = 1''$) and topographical ($1600' = 1''$) sheets. 2°. The use of the magnetic instead of the true meridian. As a geological critic, I should be disposed to boldly condemn what you have referred to as merely misfortunes. After an association of nine years with Professor Lesley on the Pennsylvania state survey, I am convinced, that, in the successful conduct of such a survey, it is quite impracticable to attempt to attain a purely technical and systematic standard of work. All that can be done is to approach as near as possible to such a

standard, while meeting the practical demands for geological results, to aid in the economical exploitation of our mineral resources. This latter is what has popularized the work of the Pennsylvania survey, and accounts for its uninterrupted continuance with liberal appropriations for a state survey, since 1874.

The published results of the survey so far relate mostly to topographical, geotectonic, and stratigraphical geology in their economical bearings, with the exception of two volumes on paleobotany. Had any other plan than that of Professor Lesley's, which he has so efficiently carried out, been instituted, the survey would never have been so liberally supported by our state legislature, and probably would have been discontinued several years ago. The important thing in a state survey is to do the best we can. If we attempt too much, we fail in all.

In regard to the discordant scales and magnetic meridian, I would say: 1°. That the publication committee of the board of commissioners has never before authorized the printing of *general maps* on a scale larger than $1600' = 1''$. This scale was found quite too small for the anthracite-mine sheets, and it was only after the most careful consideration on the part of the committee that a scale of $800' = 1''$ was adopted for the mine sheets. The smaller scale was unfortunately adhered to for the topographical sheets, on account of the cost of publication. 2°. In the Panther Creek basin, the magnetic meridian of 1869 is always used in all surveys; and the block-lines referred to this meridian on the atlas sheets have been similarly placed on all the large working mine maps. In this form the sheets are of much greater practical value for ready reference. Had the publication of this atlas been delayed until the completion of the astronomical determinations of the survey in this locality, we should probably not have obtained an additional appropriation to continue the survey, which we now feel assured of receiving.

CHARLES A. ASHBURNER,

Geologist in charge.

Philadelphia, April 21, 1883.

Crayfish.

In August, 1882, while in Fairmount Park, Philadelphia, I found a crayfish in a brook emptying into the Wissahickon Creek. It had its under parts covered with young crayfish about one-eighth of an inch long.

Professor Huxley says that the English species, *Asp. fluviatilis*, lays eggs in May and June, and the young leave the female in a few days; but the young staid ten days with the female after I found them. There seems to be a difference in their habits in this respect. Last Friday, April 6, I found a female crayfish with young ones clinging to it, which I caught; and a friend now has it in a tank. Do crayfish lay eggs both early in the spring and late in the summer?

RICHARD M. ABBOTT.

Trenton, N.J.

[The writer of the above is eleven years of age. — ED.]

Marking geodetic stations.

The writer of the article in *SCIENCE* of April 13, 1883, p. 269, in referring to the method of marking the geodetic stations in the N. Y. state survey, makes the statement that the U. S. coast survey stations are indicated 'by no surface-mark whatever,' trusting entirely to the underground-mark for the preservation of the station. The writer has, doubtless, been misled by visiting a station from which the surface-marks have been removed by curious or malicious persons. In the coast survey the greatest stress is